Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/846
JAPAN
February 1964
Submitted in:
ENGLISH and FRENCH

Confidential until official release during Conference

Abstract

SUBCRITICALITY MEASUREMENTS BY PULSED METHOD AND CRITICAL EXPERIMENTS ON LIGHT WATER SYSTEM

K. Sumita[1], Y. Kaneko[1], S. Ogura[2], M. Mukae[2], M. Imai[3], T. Wajima[3], S. Kobayashi[3], H. Kikuchi[3], S. Matsuura[1], T. Haga[1], I. Kobayashi[1] and M. Ueda[1]

The present paper gives a brief outline firstly of the results of the pulsed experiments on graphite and light water moderated systems, and secondly of the critical experiments on H_2O - UO_2 system.

The experimental methods for reactivity measurement is a highly subcritical system, which are based on the measurement of persisting mode and based on that of prompt mode, have the theoretical and experimental difficulties. Those are stressed in a reflected system.

The purpose of the subcriticality study is to establish another concept to avoid the above-mentioned problems, and to describe rigorously situation of neutron multiplication in a reflected subcritical system. The concept is that the prompt neutron decay constant of fundamental mode α_o should be used directly as a measure of neutron multiplication. Because this quantity is to be uniquely measurable free from spatial and energetic dependence, and calculable from the fundamental equations. In order to prove this characteristic of α_o, a series of pulsed neutron experiments was made at various subcritical state in a reflected graphite moderated enriched fuel system (SHE) and a light water moderated natural UO_2 system, in JAERI and MAPI, respectively.

1. Japan Atomic Energy Research Institute (JAERI), Tokai, Ibaragi.
2. Mitsubishi Atomic Power Industry Inc. (MAPI), Kitabukuro, Omiya, Saitama.
3. Hitachi Central Research Laboratory, Ozenji, Kawasaki, Kanagawa.

The multigroup subcritical kinetics of the reflected reactor have been extended, and the direct comparison between the experimental results from pulsed neutron experiment and the calculated values from multigroup treatment about the above-mentioned systems have been made to investigate this concept. The difference between measured and calculated values of α_o was fairly small.

Reactivities, reactivity coefficients and flux distributions were measured with Ozenji Critical Facility, OCF (Hitachi, Ltd.) and Tanktype Critical Assembly, TCA (JAERI), and compared with theoretical analyses. Lattices studied with these facilities are of pelletized and swaged UO_2 cladded with Al tubes (enrichment: 2.5%, 1.5%, 1.84%: volume ratio: 1.5, 2.5 and 1.84).

Flux distributions for fully reflected and partly immersed cylindrical, rectangular and annular cores and thermal spectrum were measured with various activation detectors such as Dy, Cu, Lu, Au, Mn and In. Measurements of reactivity include those of critical mass, of temperature coefficient and of spatial dependent reactivity effects of void, fuel and absorption materials.

Results of these experiments were analysed primarily with a few group diffusion models and agreement between experiments and calculations was fairly good. More refined analyses taking account of the spatial dependent spectrum and transport approximations are now in progress.